

Wind Energy Systems

Small ■ Micro ■ Hybrid ■ MET ■ Windmills

I. Scale of Systems

A. Small Wind Energy System

1. A wind energy conversion system designed to supplement other electricity sources as an accessory use to existing buildings or facilities, wherein the power generated is used for primary for onsite consumption.
2. A small wind energy system consists of a single wind turbine, a tower, and associated control or conversion electronics, having a rated name plate capacity of not more than 50 kilowatts (kW) for residential uses and not more than 100 kW for other uses.
3. For the purpose of residential net metering, Virginia Code §56-594B limits the electrical generating facility to a capacity of not more than 10 kilowatts (kW).

B. Micro Wind Energy System (Building Integrated)

1. A building-mounted wind energy conversion system that has a manufacturer's rating of 10 kW or less and projects no more than fifteen (15) feet above the highest point on the roof and shall not be considered a small wind energy system in terms of area and setback requirements. This definition also covers, for the purposes of this zoning provision, other wind energy systems primarily used for land-based applications which may be permanently mounted and operated on a building.

C. Hybrid Energy Systems

1. An energy conversion system that uses more than one technology to produce energy or work (i.e. a wind-solar system)

D. Meteorological Towers (METs)

1. A temporary tower equipped with devices to measure wind speeds and direction, used to determine how much wind power a site can be expected to generate.
2. A permit for a temporary MET Tower shall be valid for a maximum of three (3) for large or utility wind systems and one (1) year for a small or hybrid systems, after which an extension may not be granted.
3. Small anemometers may be installed directly on buildings without a zoning or building permit.

E. Windmills (*Should we classify as small wind system?*)

1. A machine designed to convert the energy of the wind into more useful forms of energy using rotating blades to turn mechanical equipment to do physical work, without producing energy. Windmills are no greater than 60 feet in height (*current zoning regulations allows 100 feet in agricultural districts for amateur radio towers*) and are operated by the wind usually acting on oblique vanes or sails that radiate from a horizontal shaft. Wind mills, as defined, are not regulated as small wind energy systems. Possible uses would be a wind-driven water pump or electric generator.

II. Definitions

- A. *Anemometer*: A device that measures the wind speed and transmits wind speed data to the controller.
- B. *Eligible Customer-generators*: A customer that owns and operates, or contracts with another persons to own, operate, or both, an electrical generating facility that (i) has a capacity of not more than 10 kilowatts for residential customers and 500 kilowatts for nonresidential customers unless a utility elects a higher capacity limit for such a facility; (ii) uses as its total source of fuel renewable energy, as defined in Virginia Sate Code §56-576; (iii) is located on the customer's premises and is connected to the customer's wiring on the customer's side of its interconnection with the distributor; (iv) is interconnected and operated in parallel with an electric company's transmission and distribution facilities; and (v) is intended primarily to offset all or part of the customer's own electricity requirements.
- C. *Fall Zone*: The potential fall area for the wind energy system, defined as the circular zone on the surface of the ground, in which a tower will collapse in the event of a structural failure.
- D. *Kilowatt (kW)*: The kilowatt is equal to one thousand watts.
- E. *Net Metering*: The difference between the electricity supplied over the electric distribution system and the electricity generated by the wind energy system which is fed back into the electric distribution system over a billing period.
- F. *Rated Nameplate Capacity*: The maximum rated output of electric power production equipment. This output is typically specified by the manufacturer with a "nameplate" on the equipment.
- G. *Rotor Diameter*: The diameter of the circle described by the moving rotor blades.
- H. *Total Height*: The vertical distance from ground level to the tip of the wind turbine blade when it is at its highest point.
- I. *Tower*: The monopole or guyed monopole structure that supports a wind energy system is mounted.
- J. *Tower Height*: The height above grade of the fixed portion of the tower, excluding the wind turbine.
- K. *Turbine*: The parts of the wind energy system including the blades, generator and tail.
- A. *Watt*: A derived unit of power in the International System of Units. It measures rate of energy conversion. One watt is equivalent to one joule (J) of energy per second.

III. General Use and Design Standards

- A. Visual Appearance/Lighting/Signage

1. A wind energy system tower shall be a monopole maintaining a galvanized steel, non-reflective finish and be a non-obtrusive and neutral color such as white, off-white or gray, unless FAA standards require otherwise, or if the owner is attempting to conform the tower to the surrounding environment and architecture, in which case it may be painted to reduce visual obtrusiveness. A photo simulation may be required at the request of the Planning Commission or the Board of Supervisors.
 2. A wind energy system tower shall not be artificially lighted unless required by the Federal Aviation Administration (FAA) or appropriate authority. Lighting of other parts of the wind facility, such as appurtenant structures, shall be limited to that required for safety and operational purposes, and shall be full cutoff luminaries.
 3. No wind energy system tower or building integrated/micro system should have any signs, lettering, images, flags, streamers, trademarks, or decorative item, other than required by law and excepting those necessary to identify the turbine manufacturer, the owner, operator, 24-hour emergency contact phone number, and warning of any danger. Appropriate warning signage shall be placed on wind turbine towers, electrical equipment and wind energy facility entrances.
- B. Minimum Setbacks (See Table II-A)
1. Potential Safety Issues: Equipment Failure & Ice Throws
 2. Prudent to require a horizontal setback at least equal to the vertical height of the system in case of a tower collapse
 3. No portion of the small wind energy system, including guy wire anchors, may extend closer than ten (10) feet to the property line.
 4. Consider allowing relief from setbacks if the applicant can secure a permanent easement from the adjacent property owner(s) providing for a fallzone?
 5. Micro System: Guided by site development regulations of applicable zoning district for principal and accessory structure
- C. Minimum Lots Sizes (See Table II-A)
1. Option 1: A small wind energy system shall not be located on a parcel smaller than one-half (1/2) acre or one (1) acre.
 2. Option 2: Graduated scale based on turbine height and fallzone. (See Section IV)
- D. Maximum Height (See Table II-A)
1. Taller Towers access stronger winds. A 10% increase in wind speed results in a 33% increase in power available to the wind turbine's rotor.
 2. Considerations for Freestanding Tower (monopole & lattice) versus Guyed Tower
 3. The applicant shall provide evidence that the proposed height of the wind energy conversion system tower does not exceed the height recommended by the manufacturer or distributor of the system.
 4. Option 1: Set maximum height for all small wind systems. Minimum setback/fallzone requirements will dictate whether parcel will support desired tower height. Allow a taller tower by SUP or possibly allow an easement from adjacent property owner.
 5. Option 2: Graduated scale – allow specific heights based on minimum lot sizes.

Table II-A							
Wind Energy Facility Type	Minimum Lot Size (acres)	Minimum Setback Requirements (1)					Maximum Height (feet)
		Occupied Building (Subject Property) (2)	Occupied Buildings (Adjacent Property) (2,3)	Property Lines (2)	Above-Ground Electric Power or Telephone Line	Right-of-Way (2)	
Small System	0.46 (20,000 sq ft)	0	1.1	1.1	1.1	1.5	120

(1) Measured from the center of wind turbine base to the property line, right-of-way, or nearest point on the foundation of an occupied building.

(2) Calculated by multiplying the required setback number by the wind turbine height.

(3) This setback proposes to reduce noise and shadow flicker impacts to any existing occupied building on adjacent properties.

Table II-B Power Rating and Height of Wind Energy Systems	
Rating (kilowatts)	Total Height (feet)
10	111.5
50	127.92
100	148.5
225	179
250	212
500	164
660	200
750	213
1,650	328
3,000	394
3,600	492
5,000	807

Source: Virginia Renewables Siting Scoring Systems (VRS³)

E. Minimum Ground Clearance/Safety

1. The minimum distance between the ground and any protruding blades utilized on a small wind energy system shall be twenty (20) feet, as measured at the lowest point of the arc of the blades.
2. Install a wind turbine on a tower with the bottom of the rotor blades at least 30 feet above any obstacle within 300 feet of the tower.

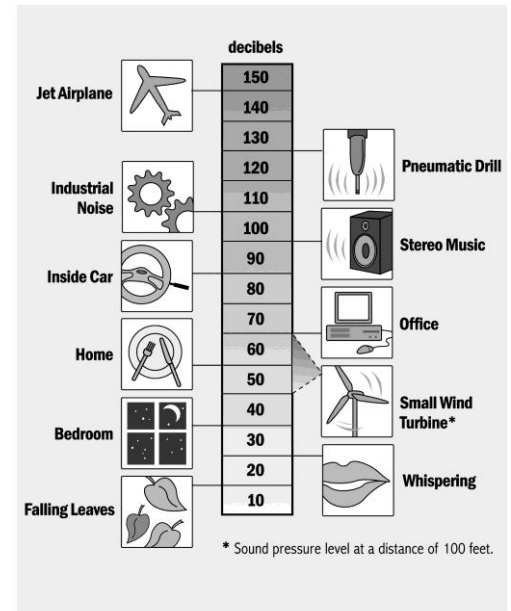
OR

The lowest point of the arc of the blade shall also be ten (10) feet above the height of any structure within one hundred fifty (150) feet of the base.

3. If a tower is supported by guy wires, the wires shall be clearly visible to a height of six (6) feet above the ground.

F. Sound Levels

- a) Audible sound from a wind energy system shall not exceed 60 decibels (dBA), as measured at the exterior of Occupied Buildings on a Non-Participating Landowner's property, school, church, hospital or public library or closest property line. The level, however, may be exceeded during short-term events such as utility outages and/or severe windstorms.
- b) Shall conform to applicable industry standards, including those of the American National Standards Institute.
- c) All electrical and mechanical components of the wind energy facility shall conform to relevant and applicable local, state, and national codes.



<http://www.awea.org/faq/noisefaq.html>

G. Removal of Defective or Abandoned Wind Energy Systems

1. Any wind energy system found to be unsafe by the building official shall be repaired by the owner to meet federal, state and local safety standards or removed within six (6) months.
2. Any wind energy system for which electricity is not generated for a continuous period of twelve (12) months shall be considered abandoned and the owner of the system shall remove the turbine within ninety (90) days of receipt of notice from the County instructing the owner to remove the abandoned wind energy system.
3. Decommissioning plans shall be submitted as part of the application for any wind energy system that describes the anticipated life of the wind power project, the estimated decommissioning costs in current dollars and the anticipated manner in which the wind power project will be decommissioned and the site restored.
4. Decommissioning shall include removal of wind turbines, buildings, cabling, electrical components, roads, and any other associated facilities.
5. Disturbed earth shall be graded and re-seeded, unless the landowner requests in writing that the access roads or other land surface areas not be restored.
6. A performance surety, in a form approved by the County Attorney, shall be submitted by the applicant prior to the issuance of a building permit in order to ensure removal of the wind energy facility when it is no longer to be used for wind generation.

IV. Permitted and Conditional Uses

- A. Micro Wind System
 - 1. Permitted use in all zoning classifications where structures of any sort are allowed.
 - 2. Allow on accessory structure?
- B. Small Wind Systems (Options)
 - 1. Permitted up to 120 feet in total height in all zoning districts (see table III-A) as long as parcel size will support minimum setbacks (fallzone) for proposed turbine. SUP for taller tower.
 - a) Allow small and hybrid systems in commercial, industrial and planned districts?
 - 2. Graduated Scale (fallzones/minimum setbacks must be met)
 - a) Less than 0.46 acre (20,000 sf): no small system allowed (encourage micro)
 - b) 0.46 acre – 1.0 acre: 60 or 80 feet max?
 - c) >1.0 acre: 120 feet max
- C. MET
 - 1. Allowed where Small and Hybrids Systems are permitted.
- D. Windmills
 - 1. Windmills are no greater than 60 feet in height (*Current zoning regulations allow 100 feet amateur towers in agricultural districts*). Permitted by right in Agricultural Districts and in EP district?
 - 2. Consider allow on larger R-1 or PRD parcels?

V. Other Questions, Comments or Concerns?

Table IV-A Permitted Uses (Proposed)

TYPE OF SYSTEM	AG-3	AG-1	AR	AV	R-1	R-2	R-3	R-4	PRD	R-MH	NC	C-1	C-2	PCD	I-1	I-2	PTD	EP
Small	R*	R*	R*	R*	R*	R*			?		R*	?	?	?	?	?	?	?
Micro (Building Integrated)	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*	R*
Hybrid	R*	R*	R*	R*	R*	R*			?		R*	?	?	?	?	?	?	?
Wind Mill	R*	R*	R*	R*	?													R*
MET	R*	R*	R*	R*	R*	R*			?		R*	?	?	?	?	?	?	?

Table IV –B Current Zoning Regulations Pertaining to Towers

TYPE OF TOWER	AG-3	AG-1	AR	AV	R-1	R-2	R-3	R-4	PRD	R-MH	NC	C-1	C-2	PCD	I-1	I-2	PTD	EP
Amateur Radio Tower	R*	R*	R*	R*	R*	R*	R*	R*	R*		R*	R*	R*		R*	R*	R	
Broadcasting Towers	S*	S*	S*									S*	S*	R	S*	S*		